FIG. 1A

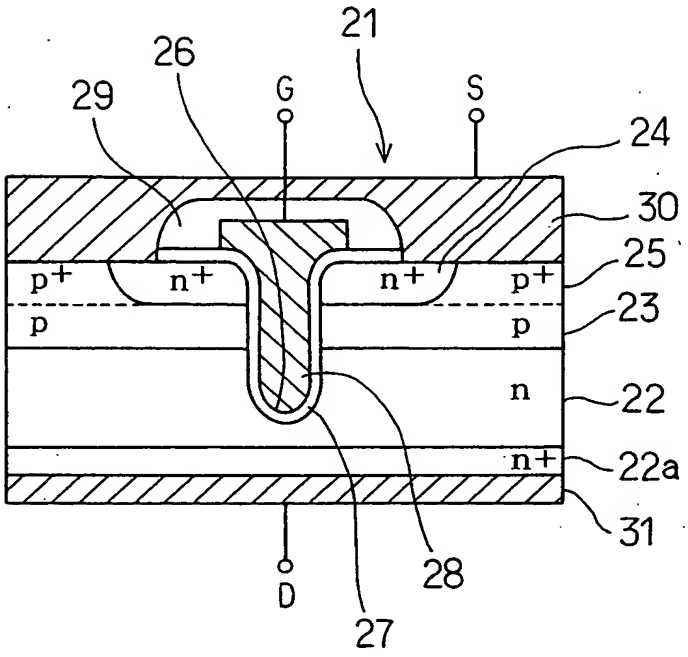
21
26
29
G
S
24
30
25
p+
n+
n+
p+
23
p
p
n
22
n+
22a
31
D
28
27

FIG. 1B

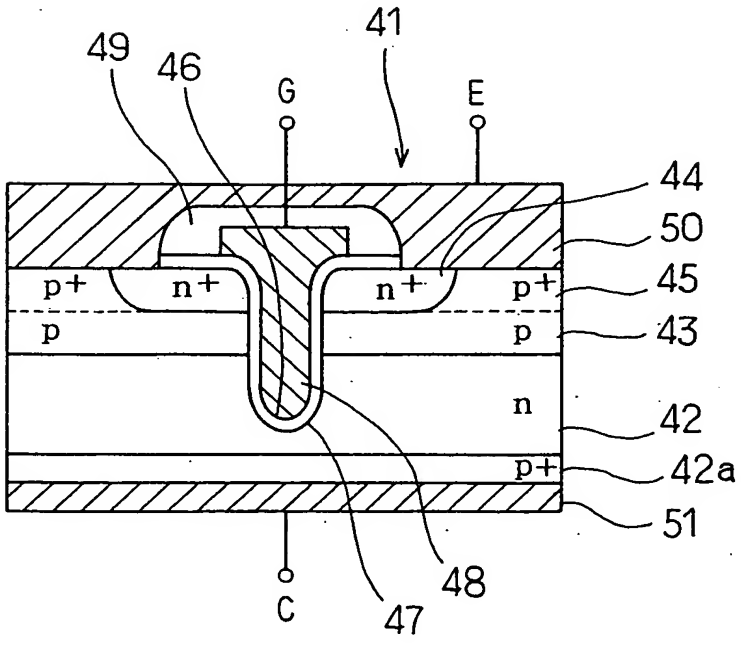
41
49
46
G
E
44
50
45
p+
n+
n+
p+
43
p
p
n
42
p+
42a
51
C
48
47

FIG. 2A

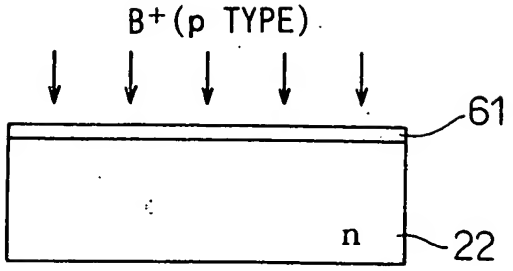

FIG. 2B

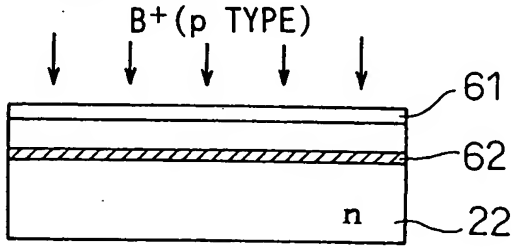

FIG. 2C

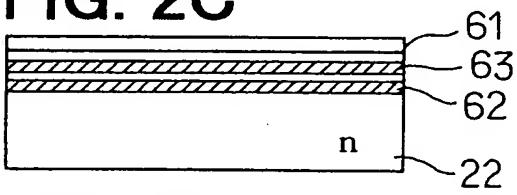

FIG. 2D

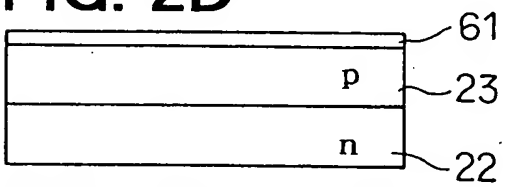

FIG. 2E

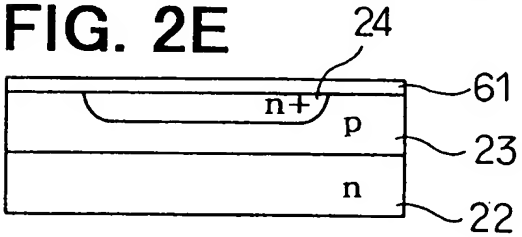

FIG. 2F

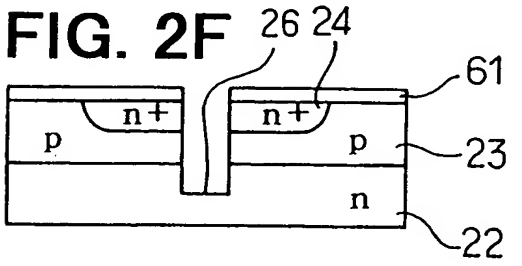

FIG. 2G

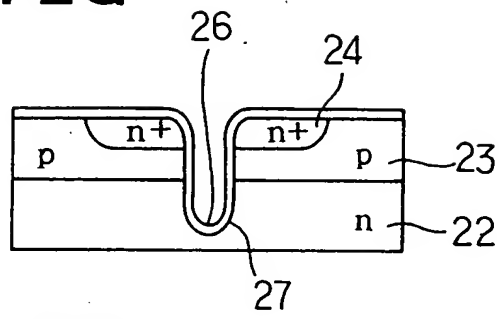

FIG. 2H

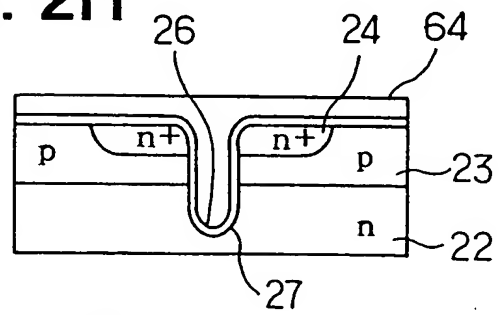

FIG. 2 I

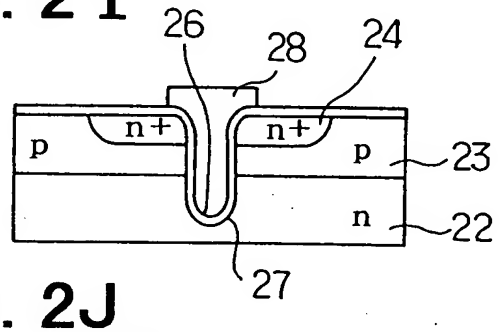

FIG. 2J

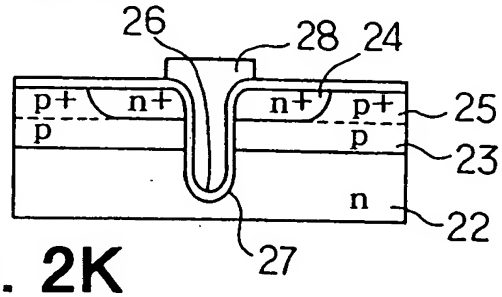

FIG. 2K

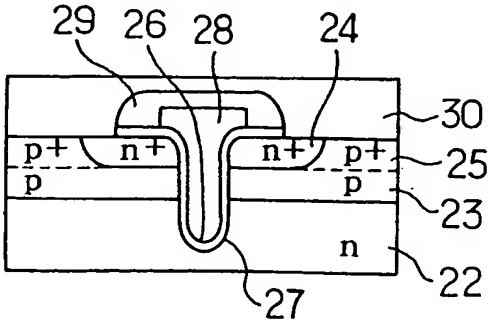

FIG. 3A

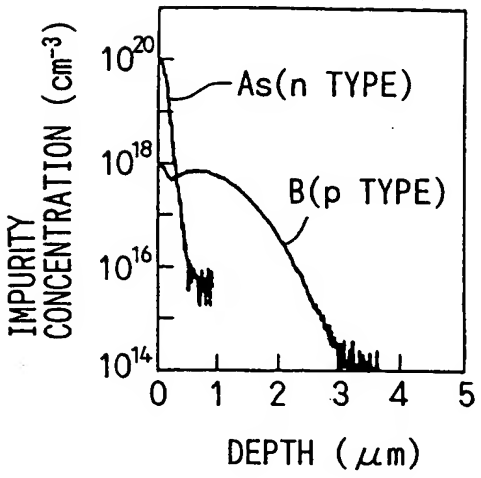

FIG. 3B

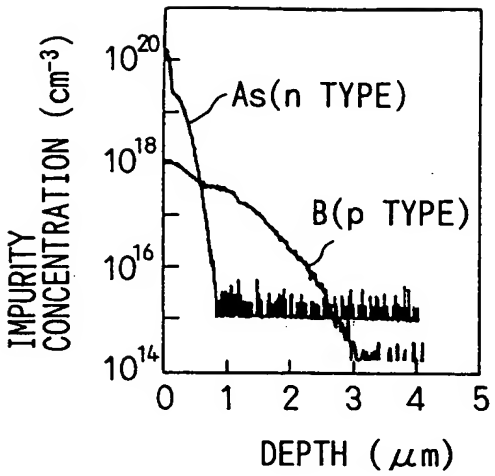

FIG. 4A

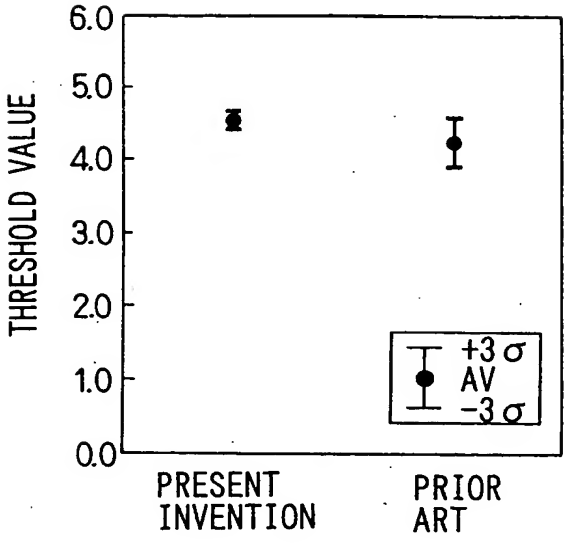

FIG. 4B

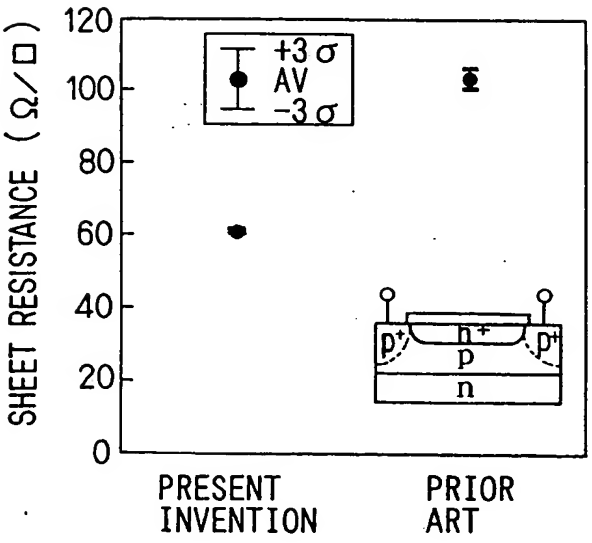

FIG. 5

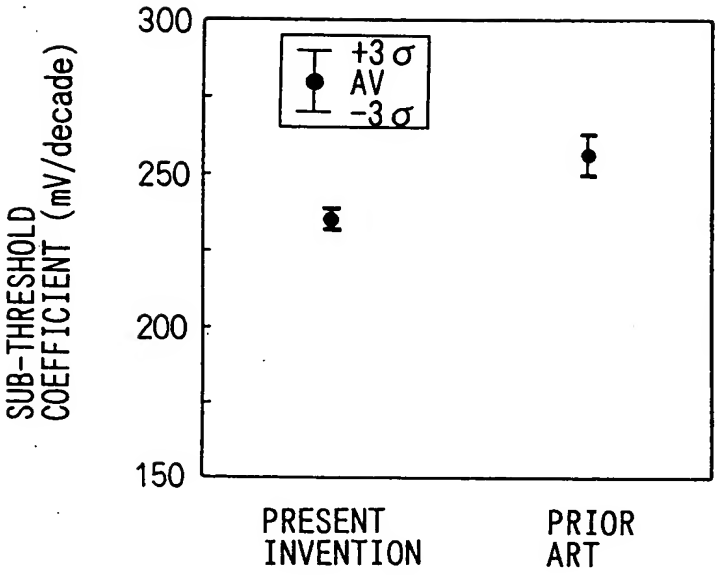
SUB-THRESHOLD COEFFICIENT (mV/decade)
300
250
200
150
+3σ
AV
-3σ
PRESENT INVENTION
PRIOR ART

FIG. 6

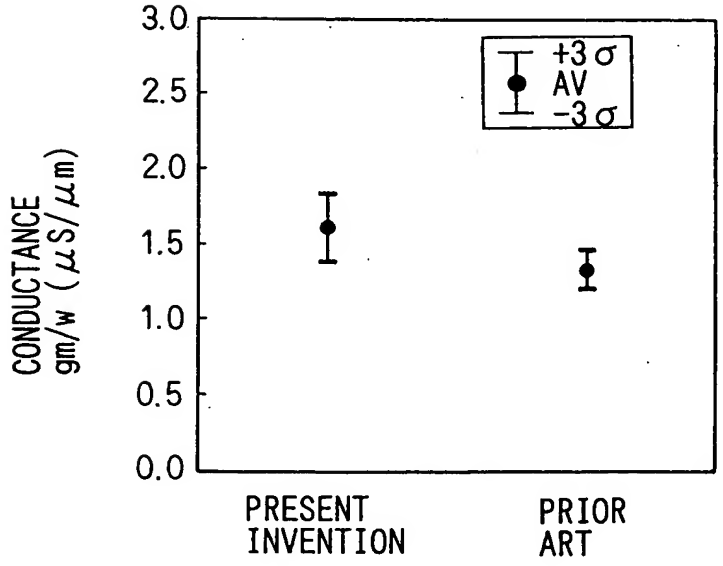
CONDUCTANCE gm/w (μS/μm)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
+3σ
AV
-3σ
PRESENT INVENTION
PRIOR ART

FIG. 7

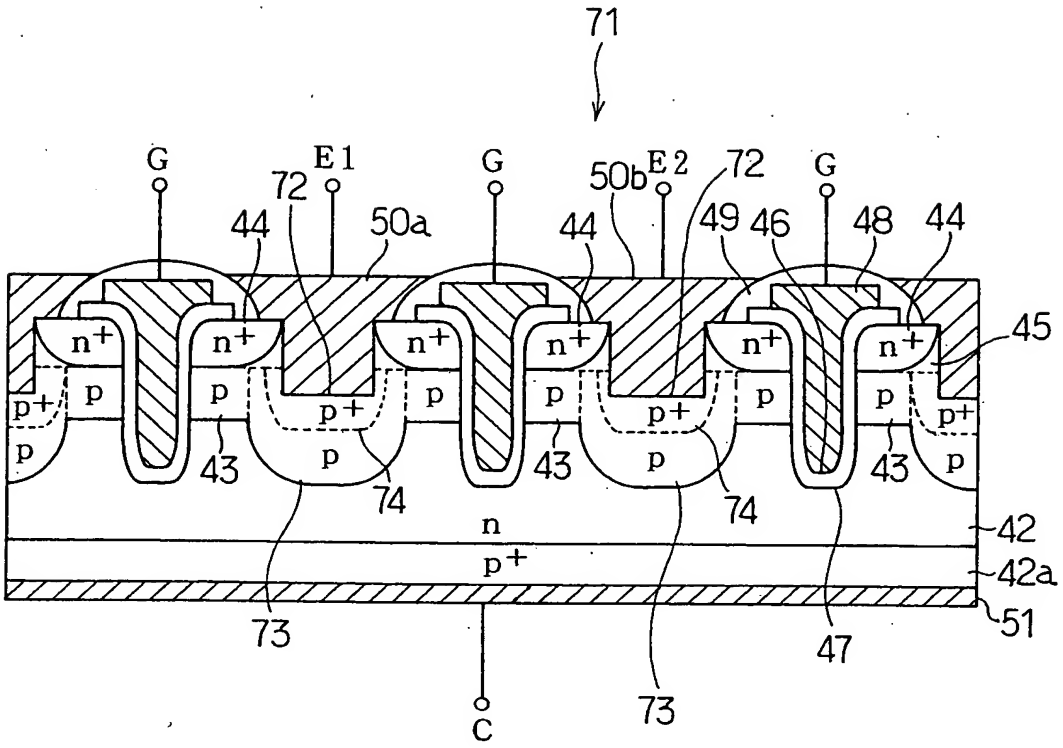
71
G
E1
72
44
50a
G
50b
E2
72
G
44
49
46
48
44
45
n+
p+
p
43
74
n
p+
42
42a
51
73
47
C

FIG. 8A

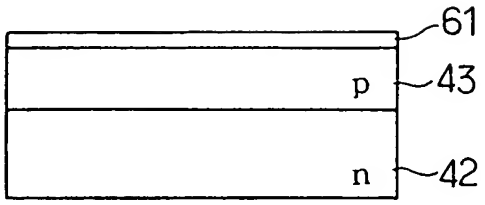

FIG. 8B

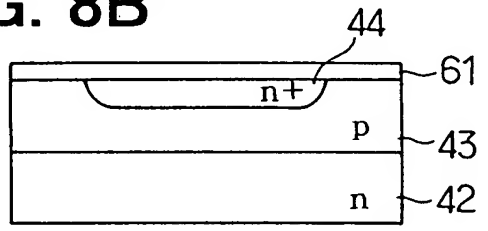

FIG. 8C

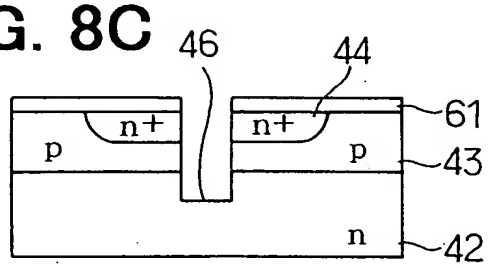

FIG. 8D

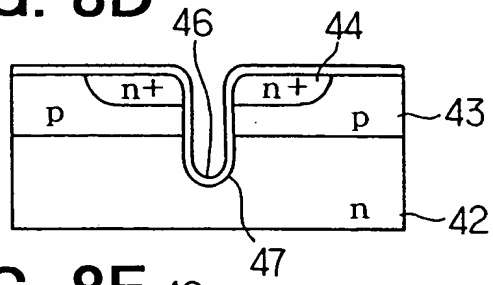

FIG. 8E

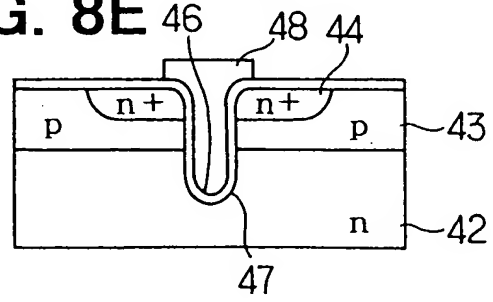

FIG. 8F

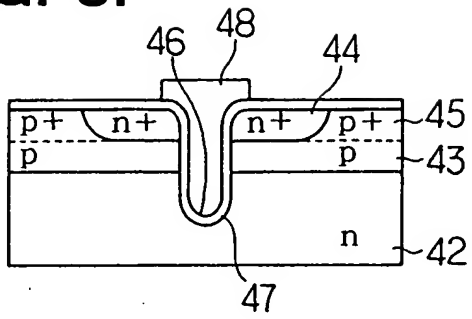

FIG. 8G

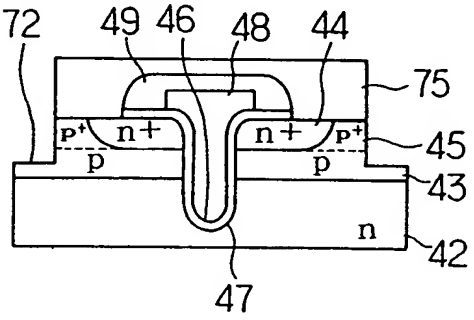

FIG. 9A

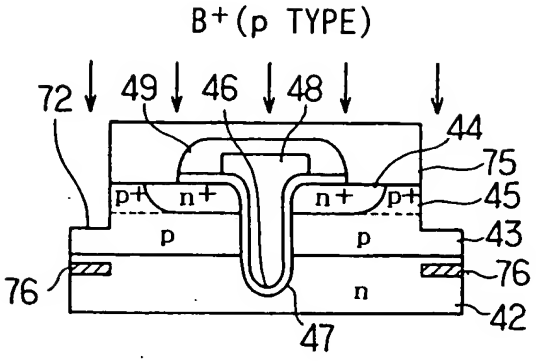

FIG. 9B

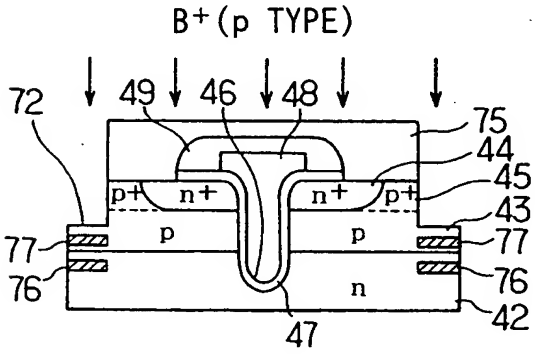

FIG. 9C

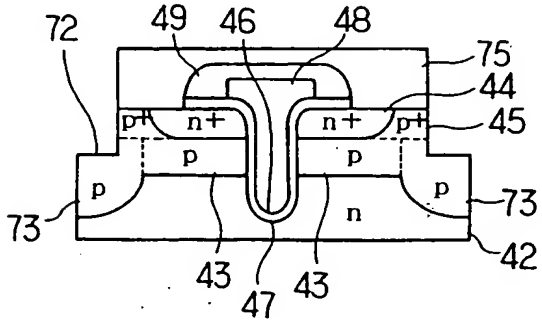

FIG. 9D

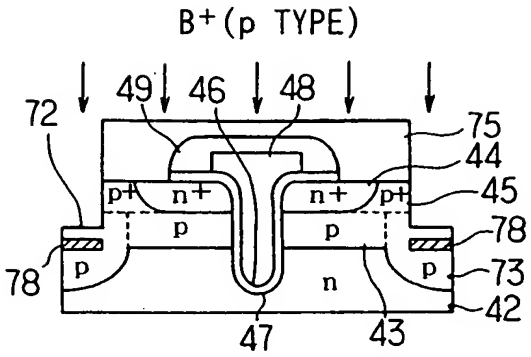

FIG. 9E

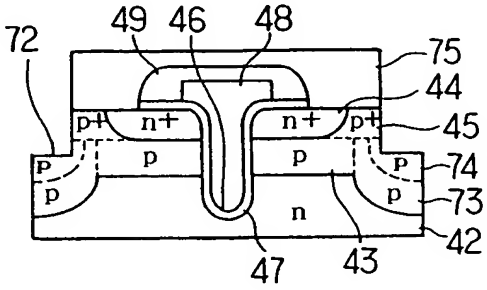

FIG. 9F

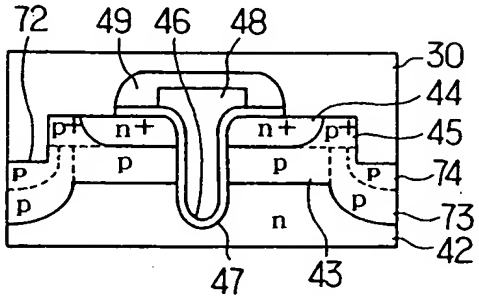

FIG. 10

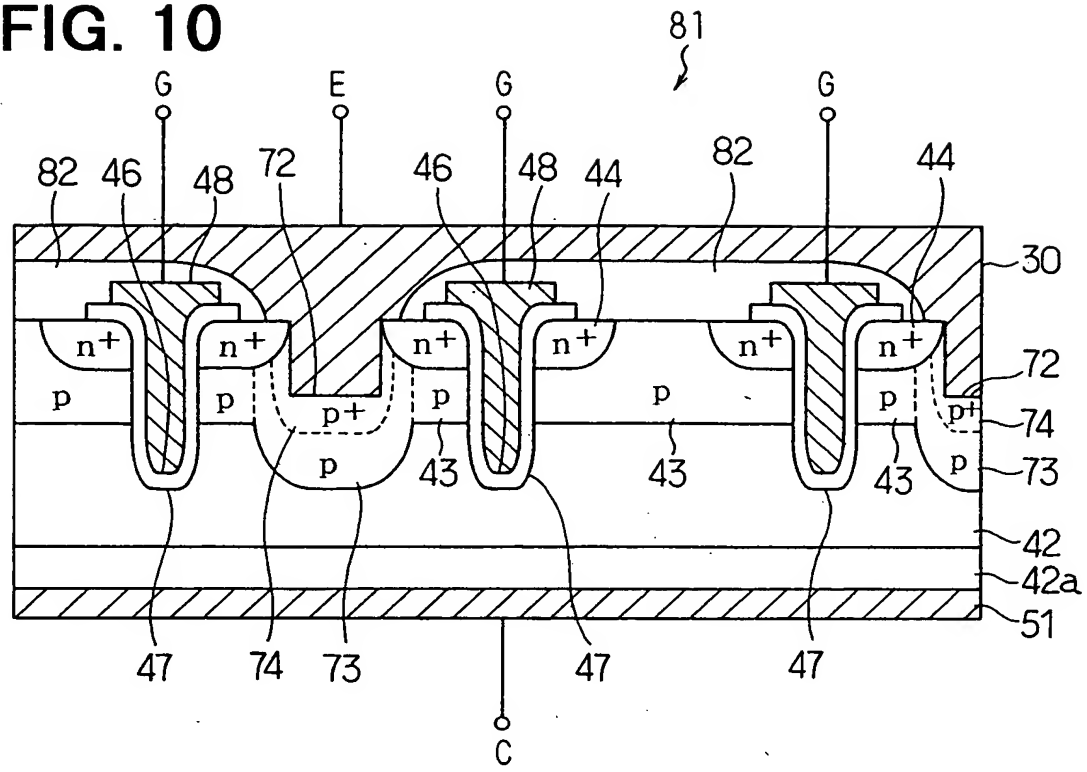
81
G
E
G
G
82
46
48
72
46
48
44
82
44
30
n+
n+
n+
n+
n+
n+
72
p
p
p
p+
p
p
p
p+
74
43
43
43
p
73
42
42a
51
47
74
73
47
47
C

FIG. 11

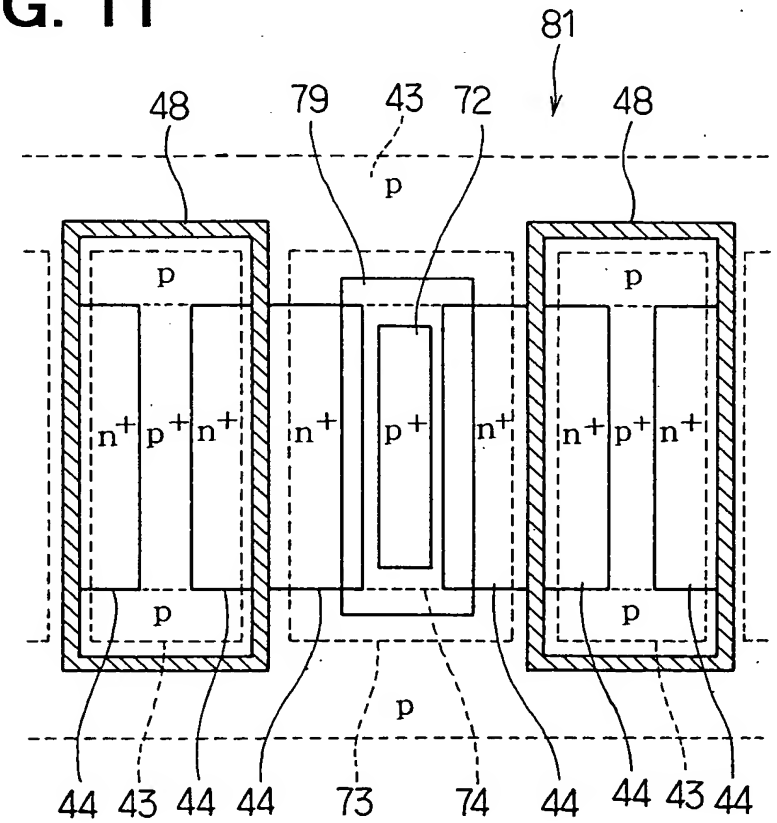
81
48
79
43
72
48
p
p
p
n+
p+
n+
n+
p+
n+
n+
p+
n+
p
p
p
44
43
44
44
73
74
44
44
43
44

FIG. 12A

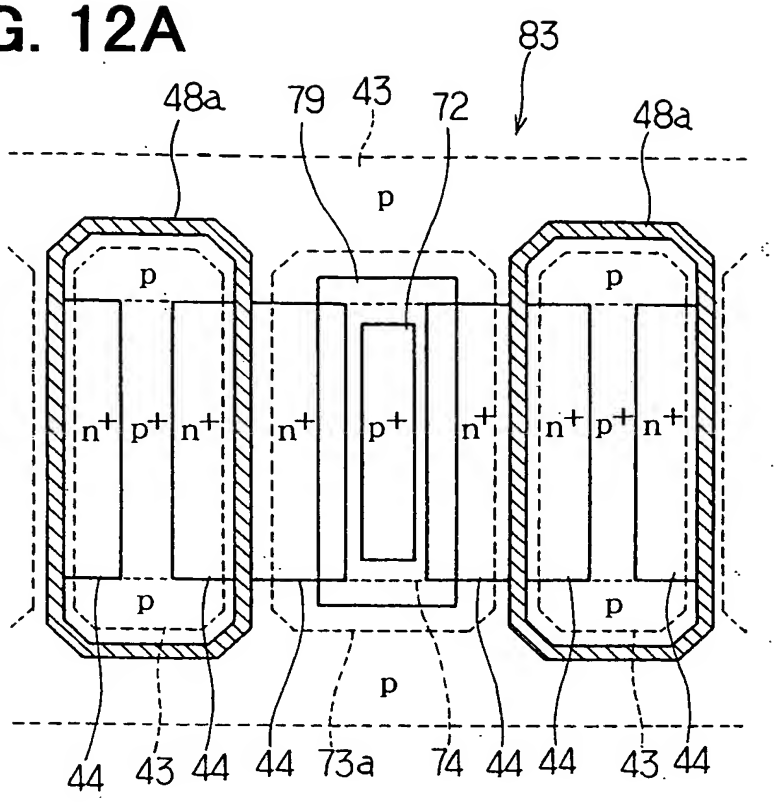

FIG. 12B

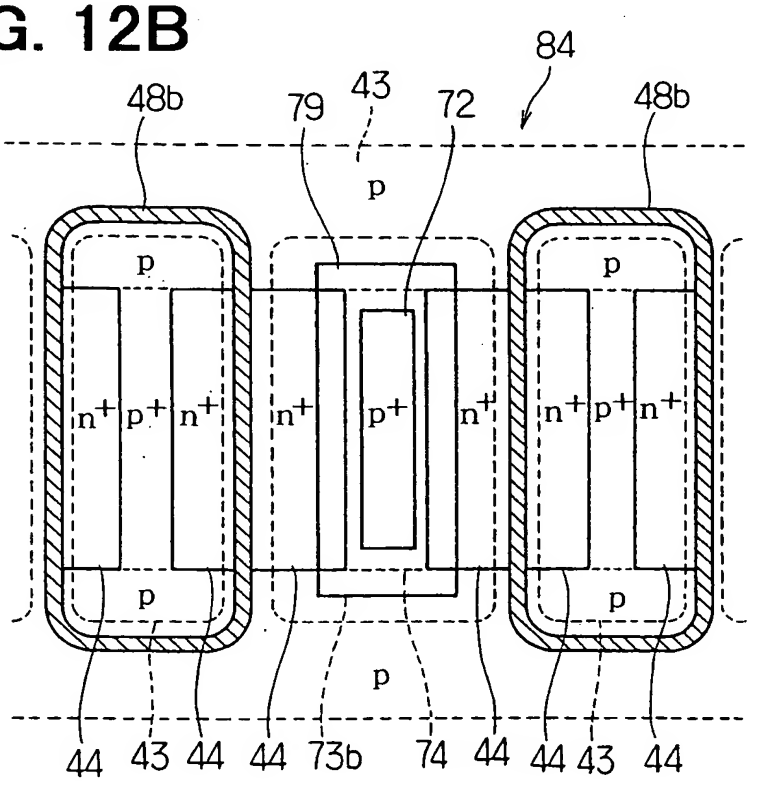

FIG. 13A

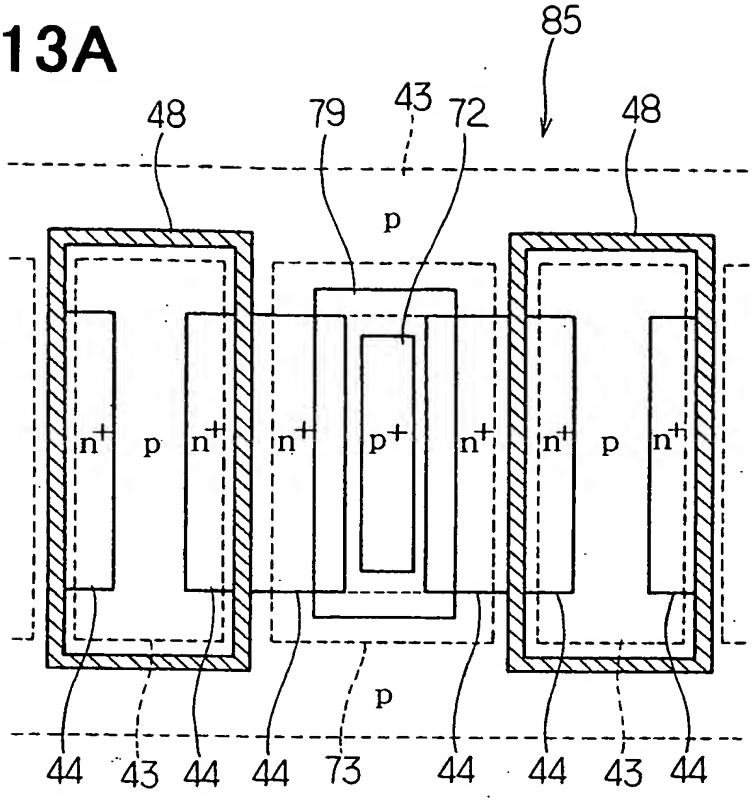

FIG. 13B

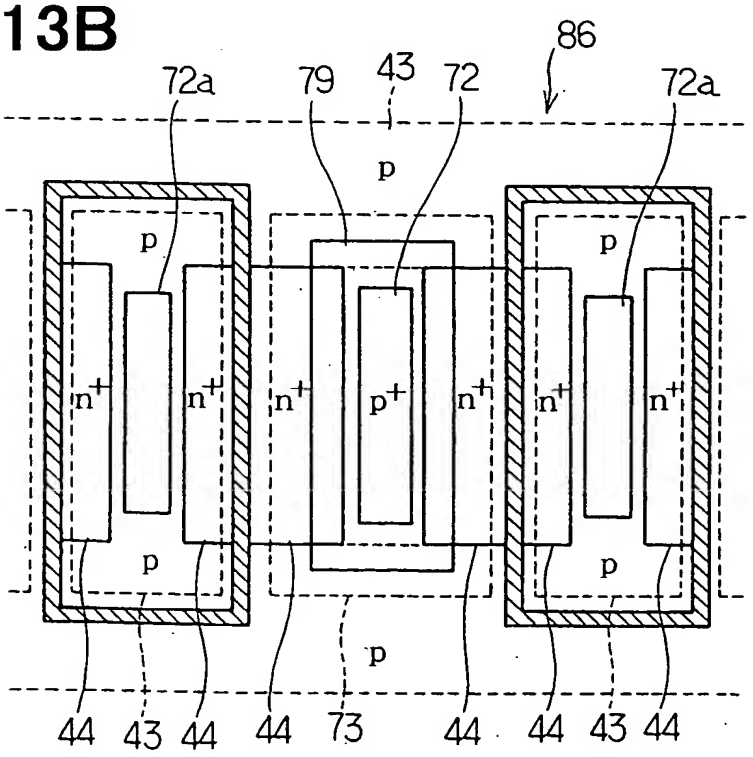

FIG. 14

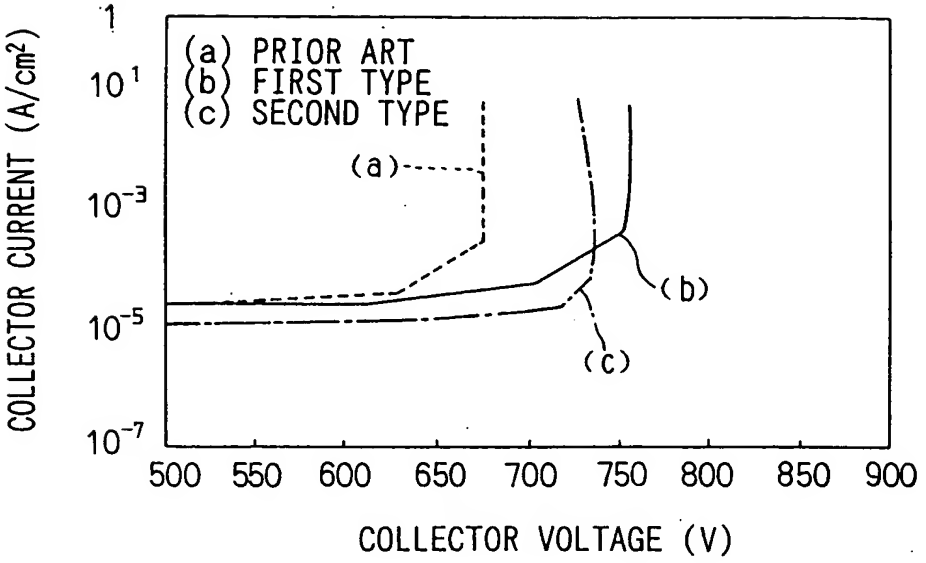
(a) PRIOR ART
(b) FIRST TYPE
(c) SECOND TYPE
(a)
(b)
(c)
COLLECTOR CURRENT (A/cm²)
1
10¹
10⁻³
10⁻⁵
10⁻⁷
500 550 600 650 700 750 800 850 900
COLLECTOR VOLTAGE (V)

FIG. 16

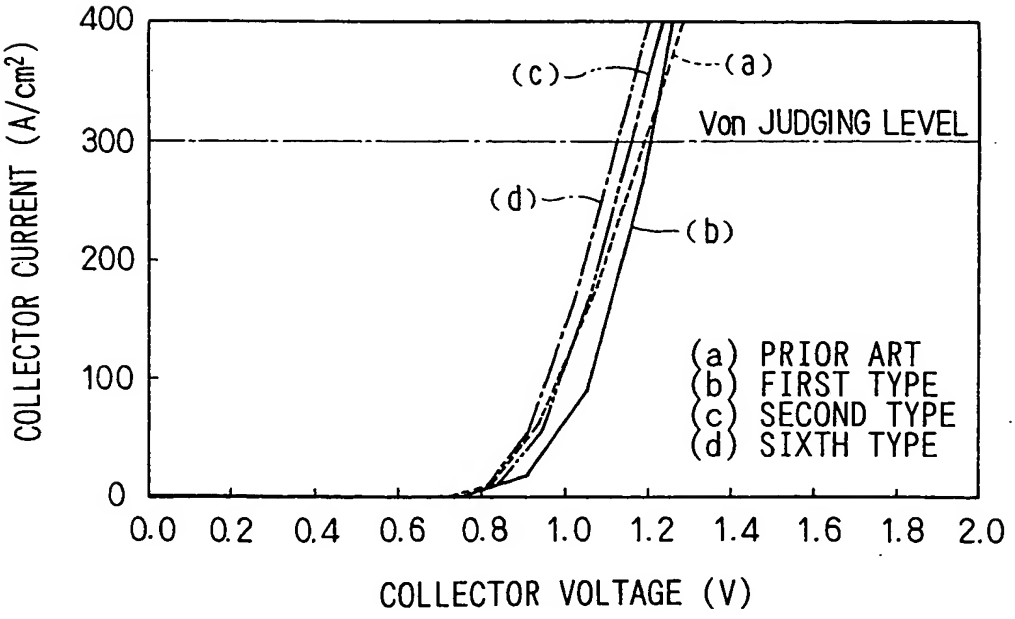
(a)
(b)
(c)
(d)
Von JUDGING LEVEL
(a) PRIOR ART
(b) FIRST TYPE
(c) SECOND TYPE
(d) SIXTH TYPE
COLLECTOR CURRENT (A/cm²)
400
300
200
100
0
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0
COLLECTOR VOLTAGE (V)

FIG. 15A

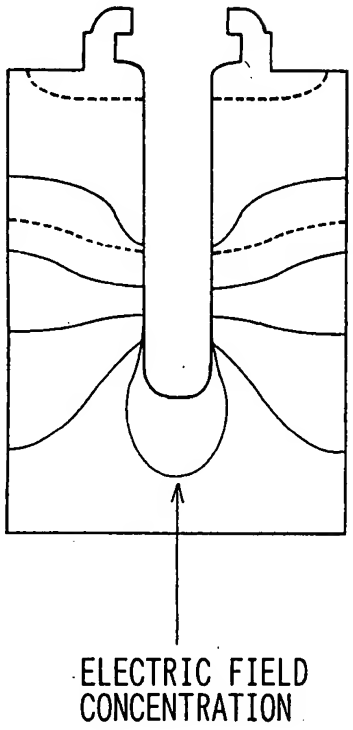

FIG. 15B

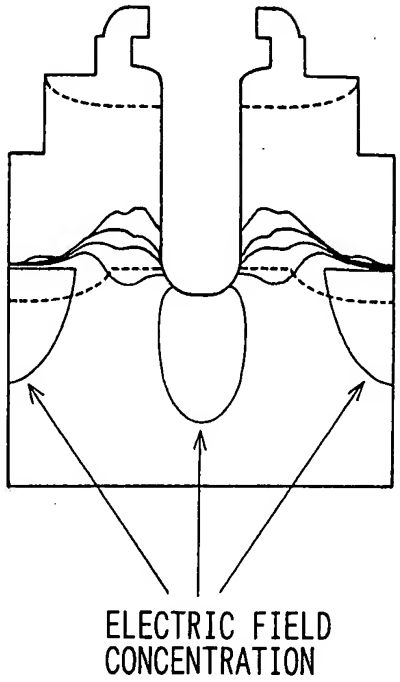

FIG. 15C

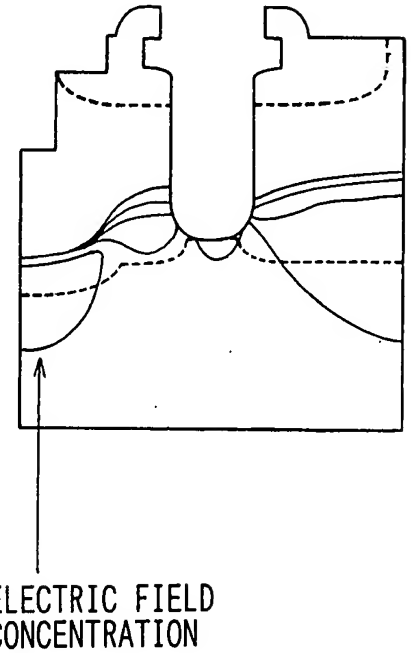

FIG. 17

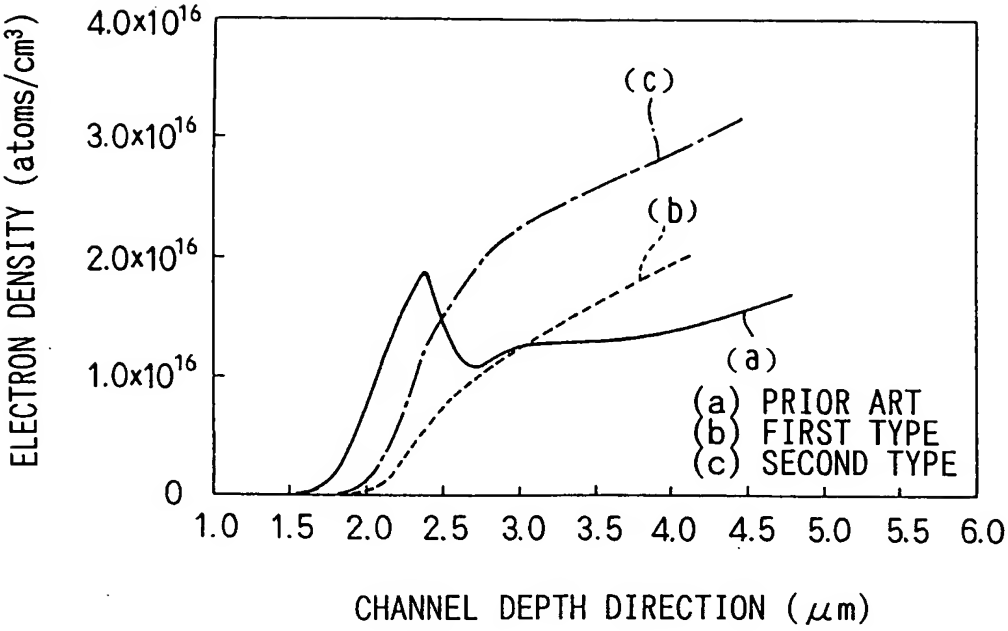
ELECTRON DENSITY (atoms/cm³)
4.0x10¹⁶
3.0x10¹⁶
2.0x10¹⁶
1.0x10¹⁶
0
1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0
CHANNEL DEPTH DIRECTION (μm)
(c)
(b)
(a)
(a) PRIOR ART
(b) FIRST TYPE
(c) SECOND TYPE

FIG. 19

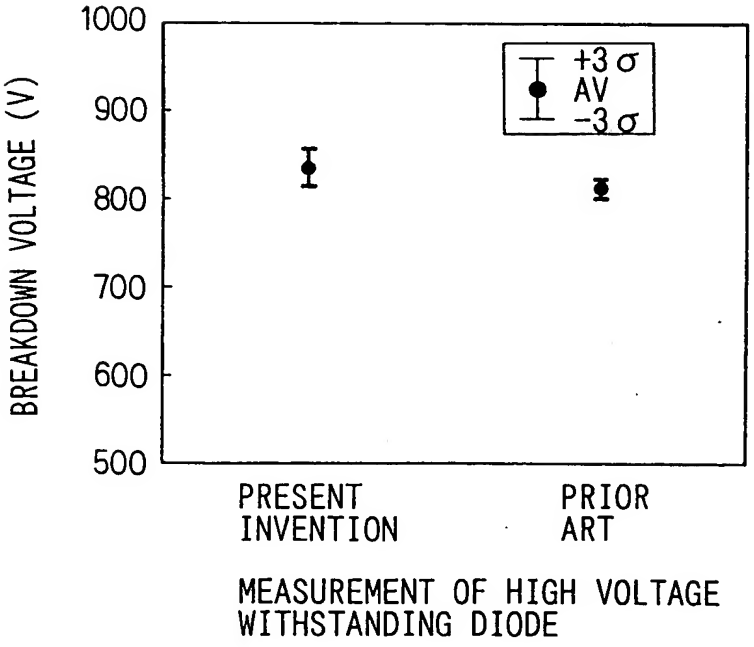
BREAKDOWN VOLTAGE (V)
1000
900
800
700
600
500
+3σ
AV
-3σ
PRESENT INVENTION
PRIOR ART
MEASUREMENT OF HIGH VOLTAGE WITHSTANDING DIODE

FIG. 18

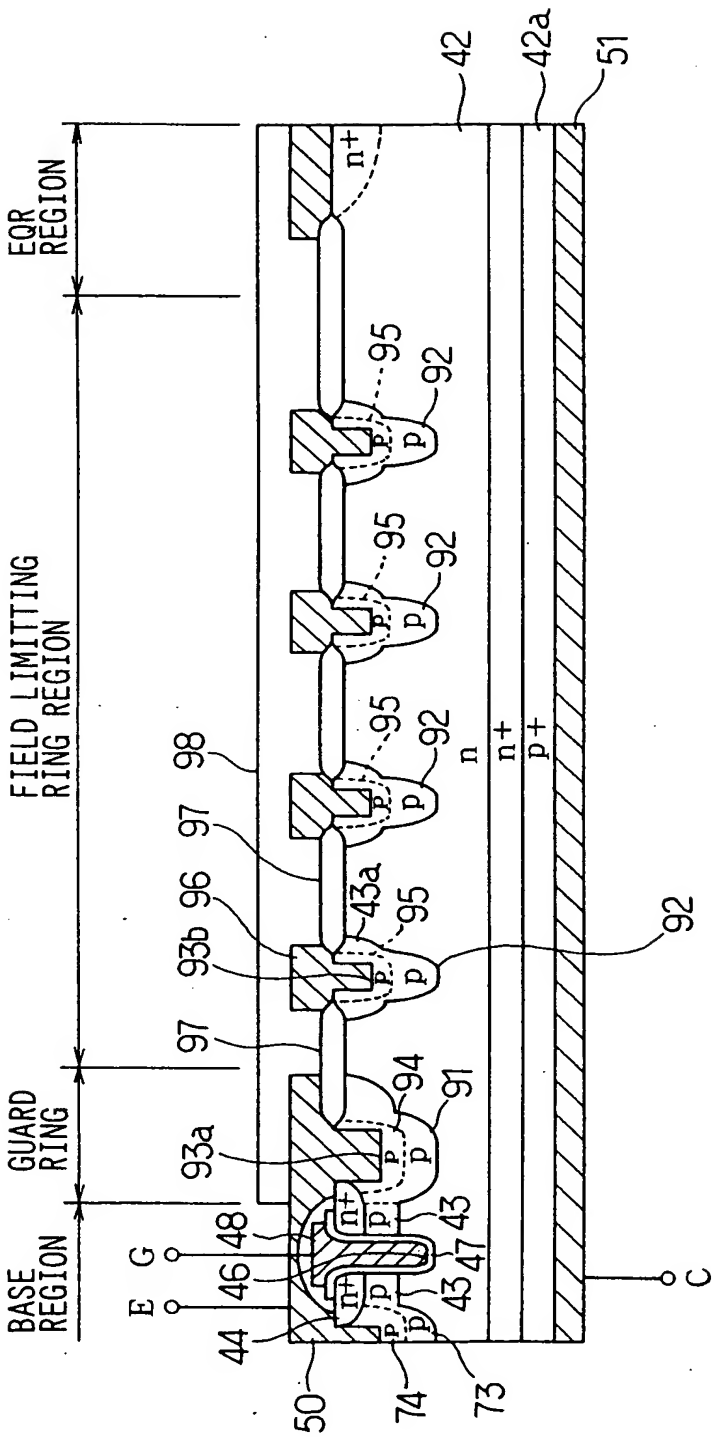
EQR REGION
FIELD LIMITTING RING REGION
GUARD RING
BASE REGION
E
G
C
42
42a
51
n+
p+
n
p
95
92
98
97
96
93b
43a
94
91
93a
48
46
44
43
47
50
74
73

FIG. 20A
PRIOR ART

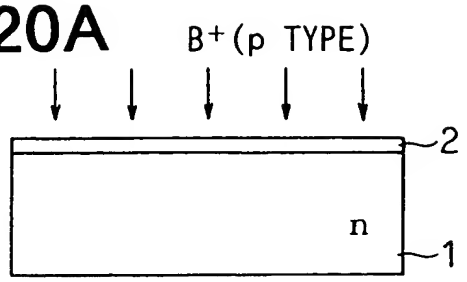

FIG. 20B
PRIOR ART

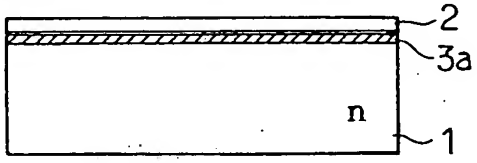

FIG. 20C
PRIOR ART

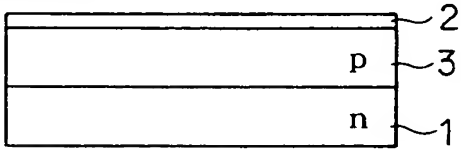

FIG. 20D
PRIOR ART

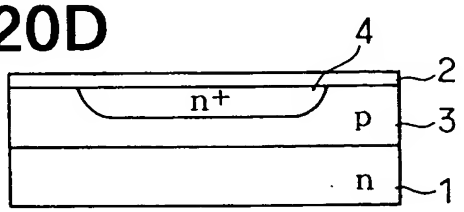

FIG. 20E
PRIOR ART

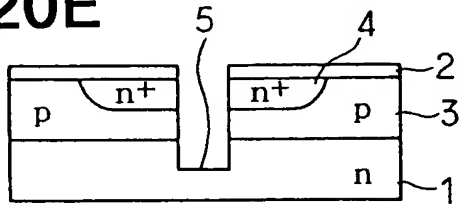

FIG. 20F
PRIOR ART

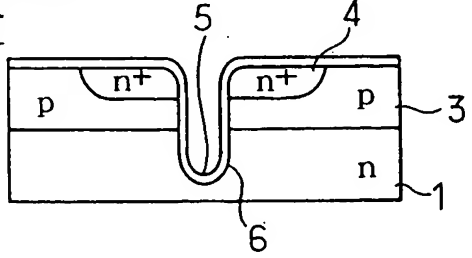

FIG. 20G
PRIOR ART

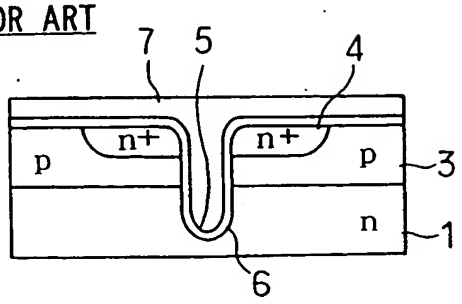

FIG. 20H
PRIOR ART

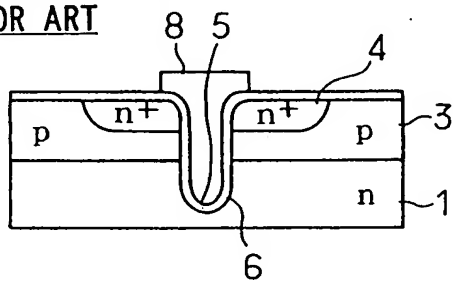

FIG. 20 I
PRIOR ART

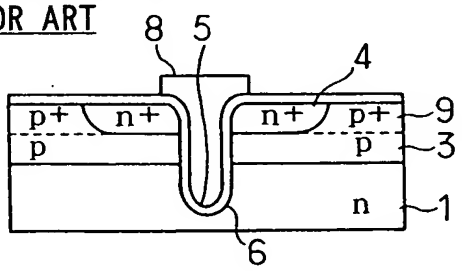

FIG. 20J
PRIOR ART

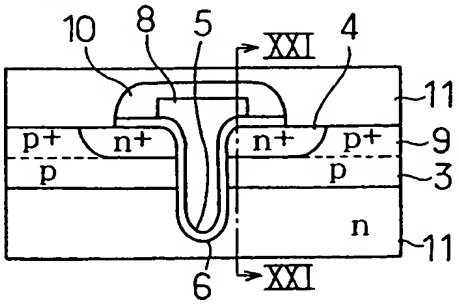

FIG. 21
PRIOR ART

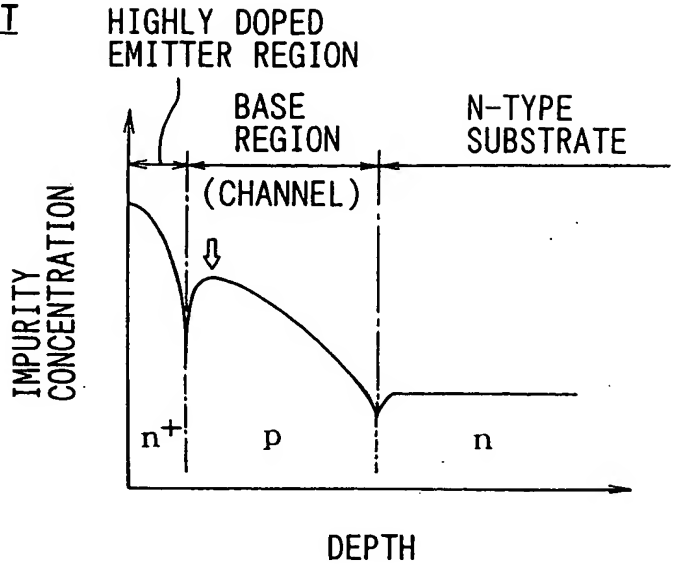

FIG. 22A
PRIOR ART

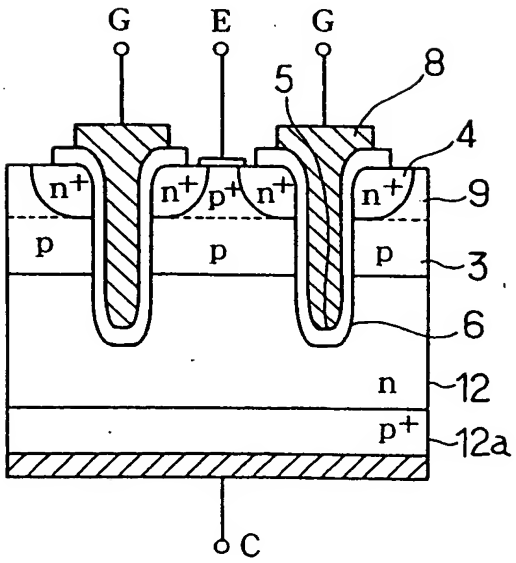

FIG. 22B
PRIOR ART

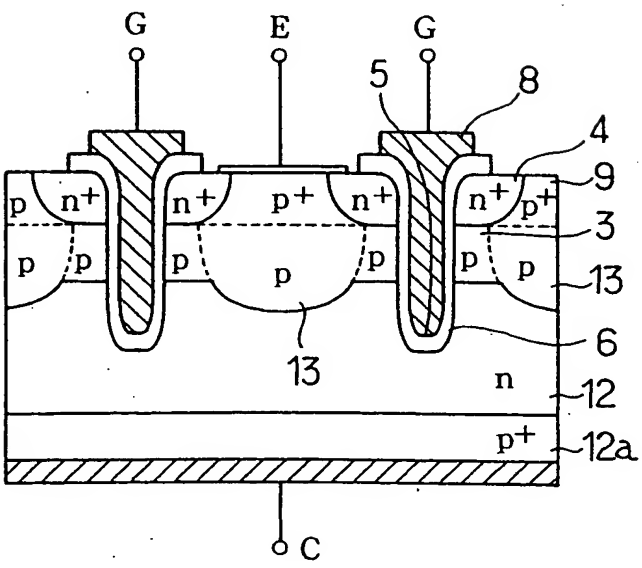

FIG. 23A
PRIOR ART

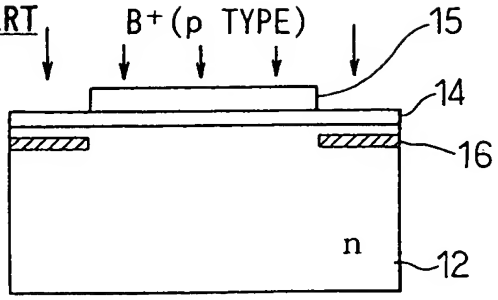

FIG. 23B
PRIOR ART

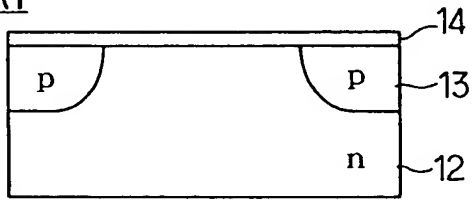

FIG. 23C
PRIOR ART

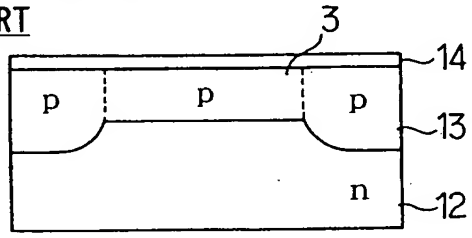

FIG. 23D
PRIOR ART

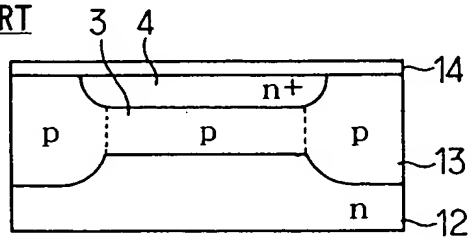

FIG. 23E
PRIOR ART

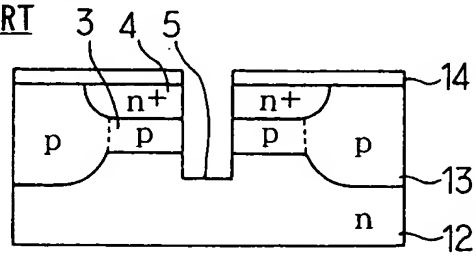

FIG. 23F
PRIOR ART

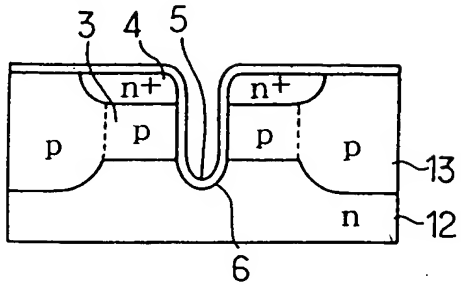

FIG. 23G
PRIOR ART

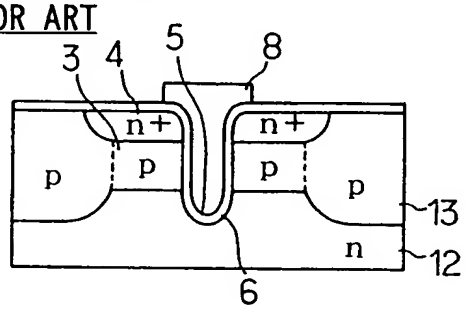

FIG. 23H
PRIOR ART

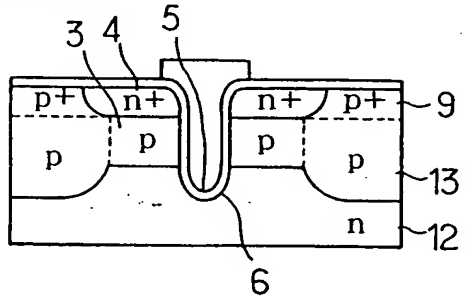

FIG. 23 I
PRIOR ART

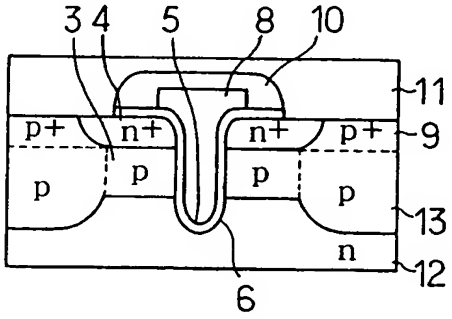

FIG. 24
PRIOR ART